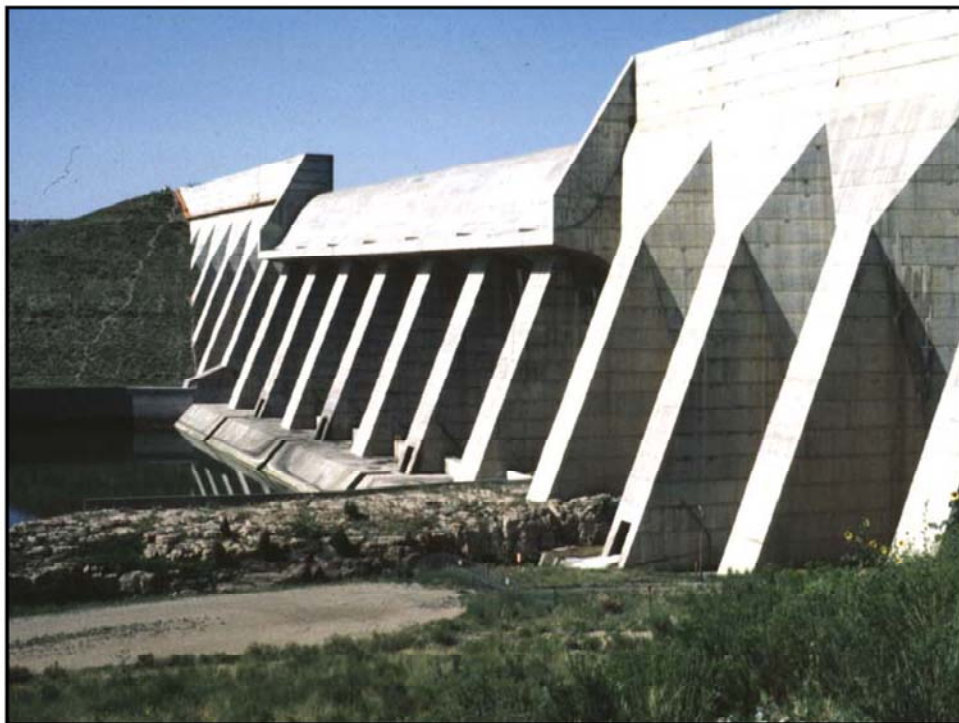


Inspection of Spillways

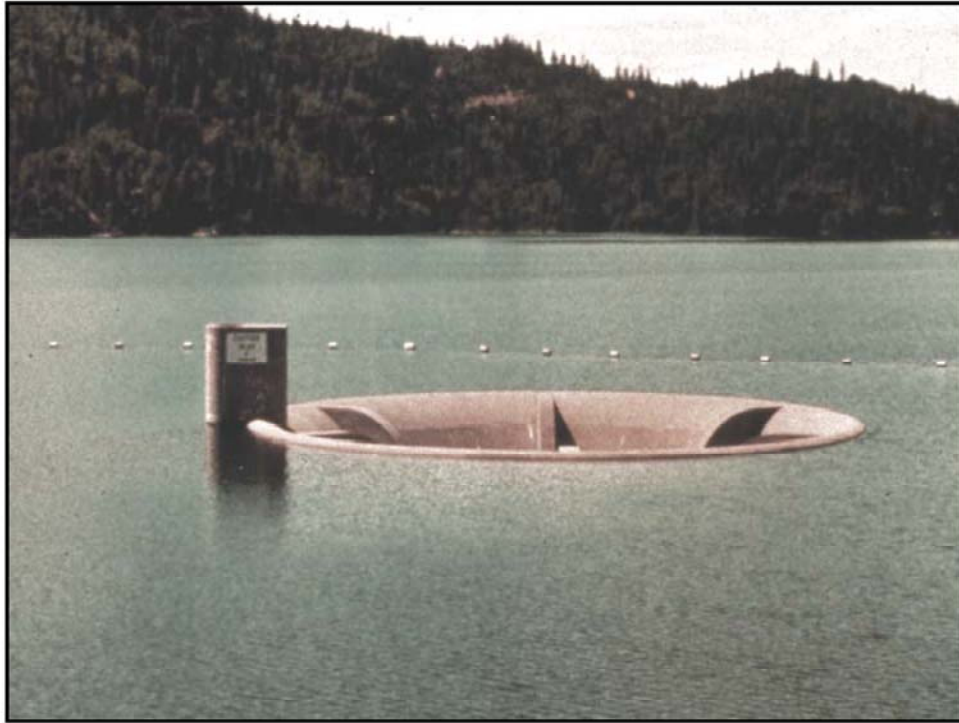
Gated
and
Uncontrolled



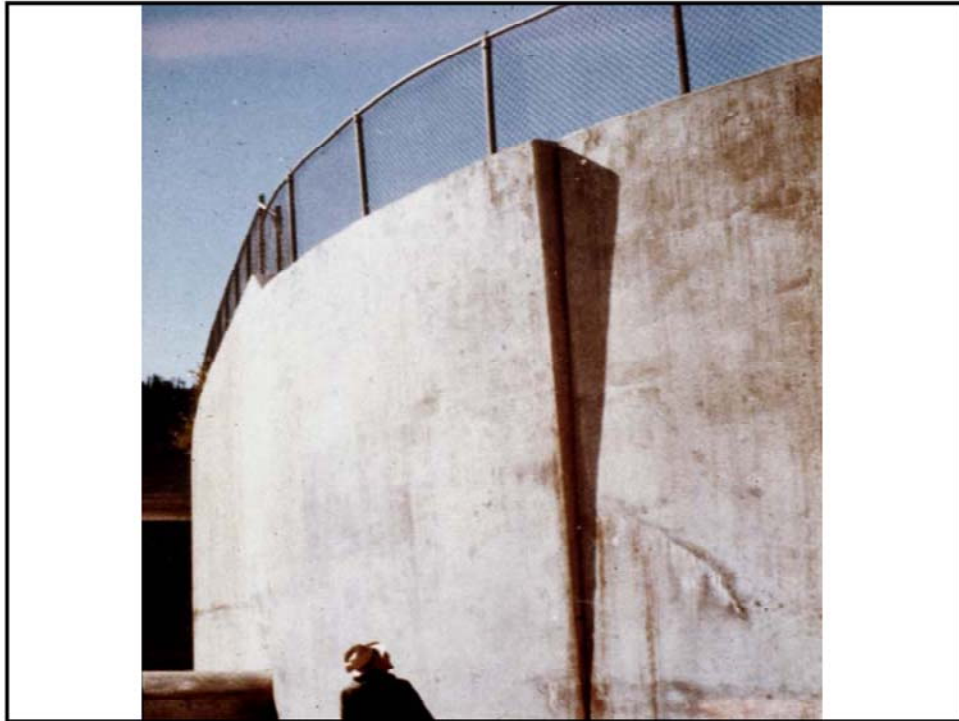








Chutes, Tunnels, & Stilling Basins



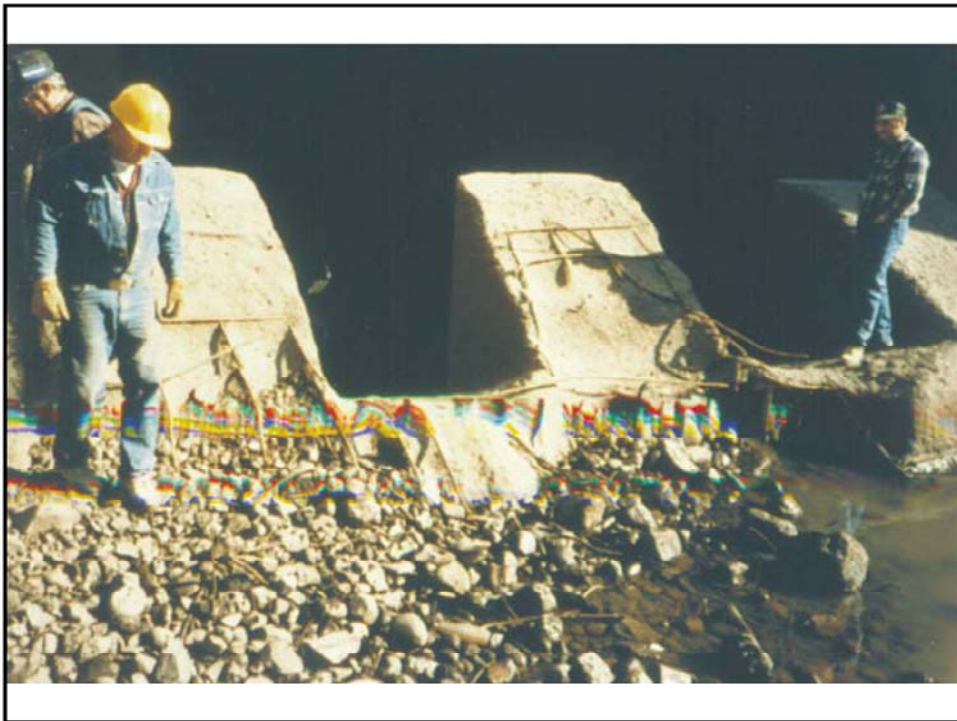


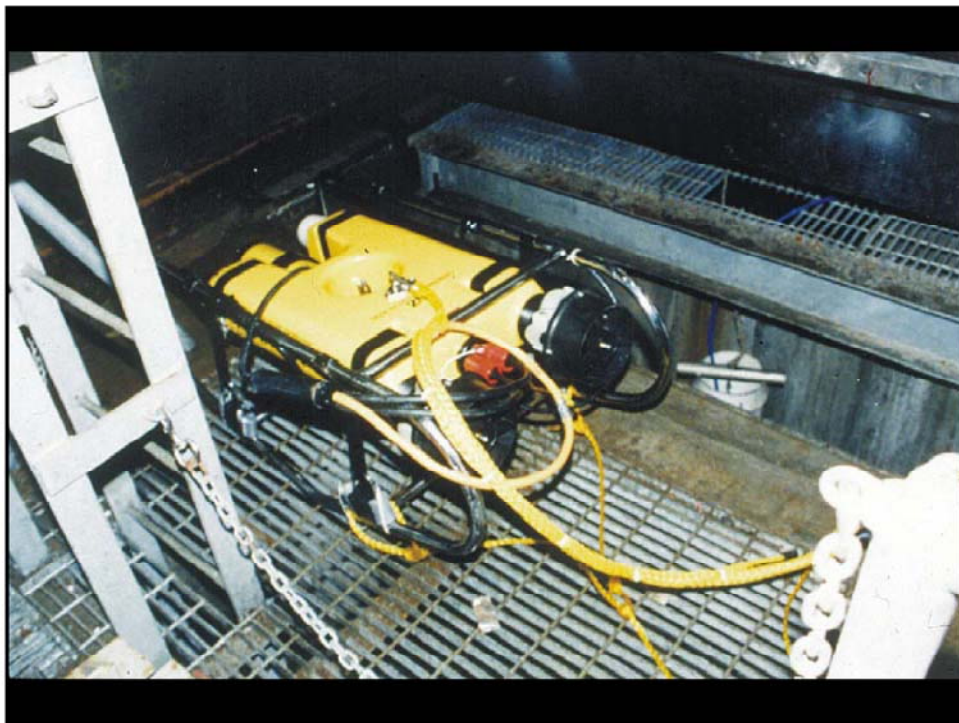






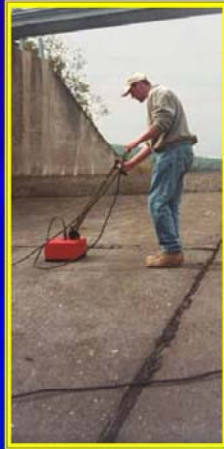
Inspection Techniques





Presentation 17:
Geophysics for Spillway and Seepage
Evaluation

Geophysics for Spillway & Seepage Evaluation



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So what is Geophysics?

The study of the earth (and other materials) using **non-intrusive** measurements of physical properties.

Some typical examples of parameters we measure are:

- Resistivity
- Seismic velocity
- Localized magnetic fields
- Gravity field
- Radar wave velocity & reflectance



How is Geophysics Helpful?

- Non-Invasive “Screening” Tool
- Does not Generate Waste (Environmental)
- Supplements Subsurface Data Between Borings
- Help Subsurface Characterization by “Seeing the Big Picture”
- Quickly Search for Specific Targets
- Trace What is Not Easily Seen (Water Seepage)
- In-Situ Estimation of Engineering Properties of Subsurface Earth Materials



Some of Our Common Tools

- Resistivity Sounding and Imaging (2-D & 3-D)
- Electromagnetics (EM)
- Ground Penetrating Radar (GPR)
- Magnetics
- Induced Potential (IP)
- Spontaneous Potential (SP)
- Seismic Techniques
- Microgravity



What Can you Do with Geophysics?

- Trace Seepage through Embankment Dams/ Ponds
- Define Limits of Voids underneath Spillway Slabs
- Determine Shear Wave Velocities for Seismic Design
- Karst Investigations
- Detect Abandoned Mines
- Map Voids and Sinkhole Potential
- Subsurface Stratigraphy
- Define Depth of Fill
- Characterize Geologic Structure
- Determine Depth to Bedrock
- Determine Depth to Non-rippable Bedrock
- Map Contaminant Plumes
- Locate steel Reinforcing in Concrete Slabs
- Locate Underground Storage Tanks (USTs)
- Define Limits of Abandoned Landfills
- Confirm Fractures in Bedrock for Groundwater Well Siting
- Assess Concrete Quality
- Monitor Vibrations from Blasting/ Construction/ Demolition
- Define GW Well Capture Zones in Fractured Bedrock
- Locate Buried Metallic Debris
-



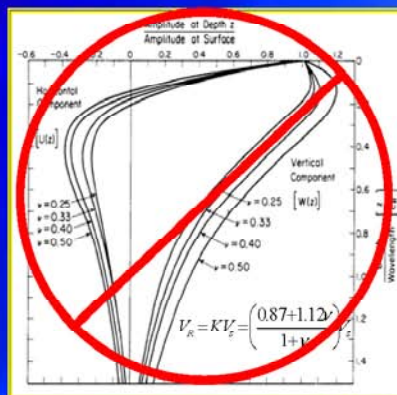
Performing Geophysical Investigations



Object of This Presentation

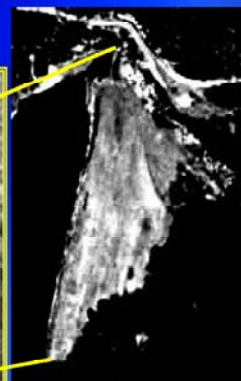
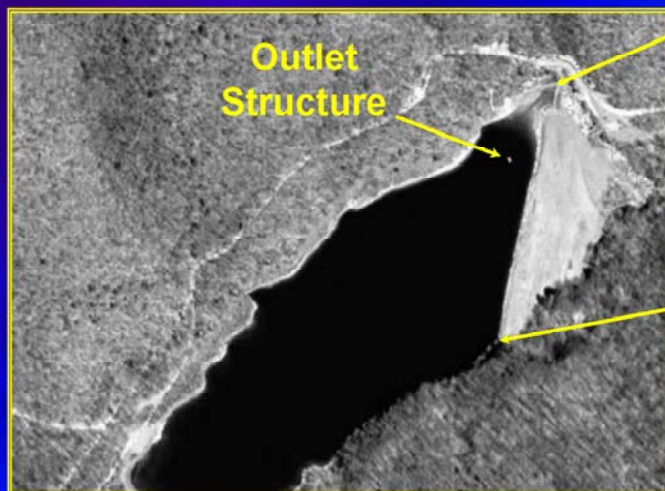
NOT to teach the theory of geophysics;

RATHER, to provide examples where geophysics is used to provide valuable information.



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Example 1, Moore's Creek Dam, Lexington, VA



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Geophysical Investigation to Define Seepage Pathways

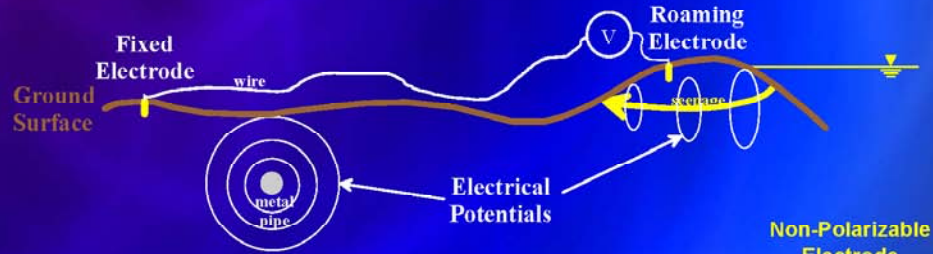
Complimentary Geophysical Techniques

- **Self Potential (SP)**
(measures voltages from water moving through porous medium)
- **Two-Dimensional Resistivity**
(measures low resistivity zones caused by increased water saturation)



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Spontaneous Potential



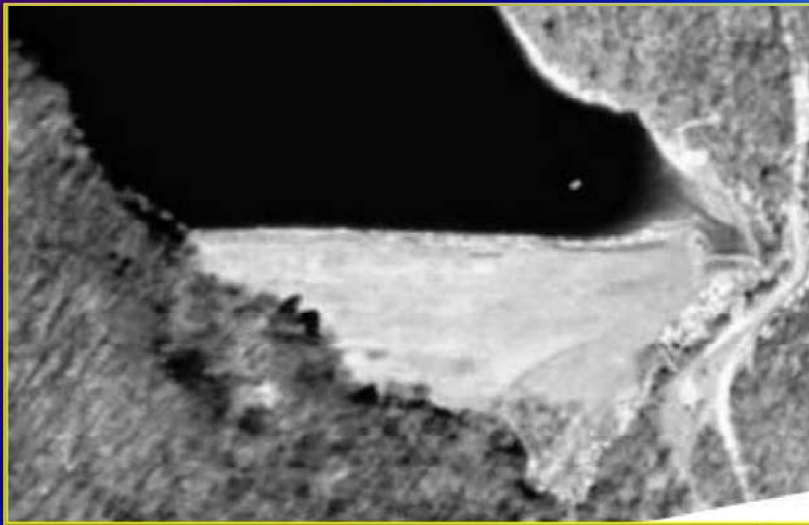
Causes of SP Anomaly

- Mineralization
- Geothermal gradients
- Bioelectric activity
- Varying electrolytic concentrations in ground water
- Geochemical variations
- Corrosion
- Changes in topography
- Telluric currents
- Streaming

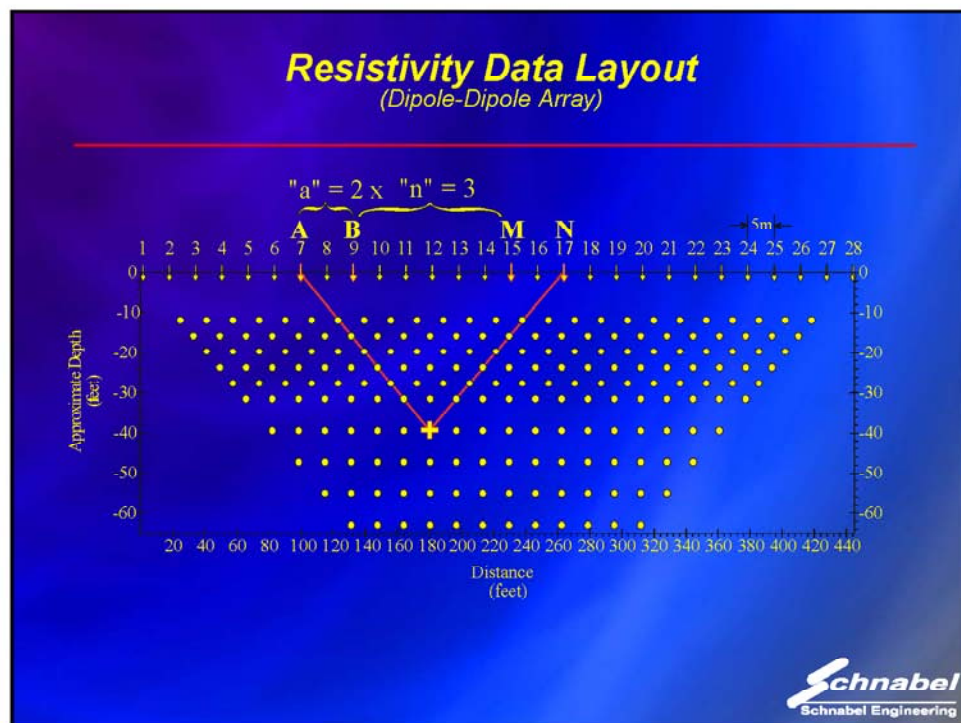
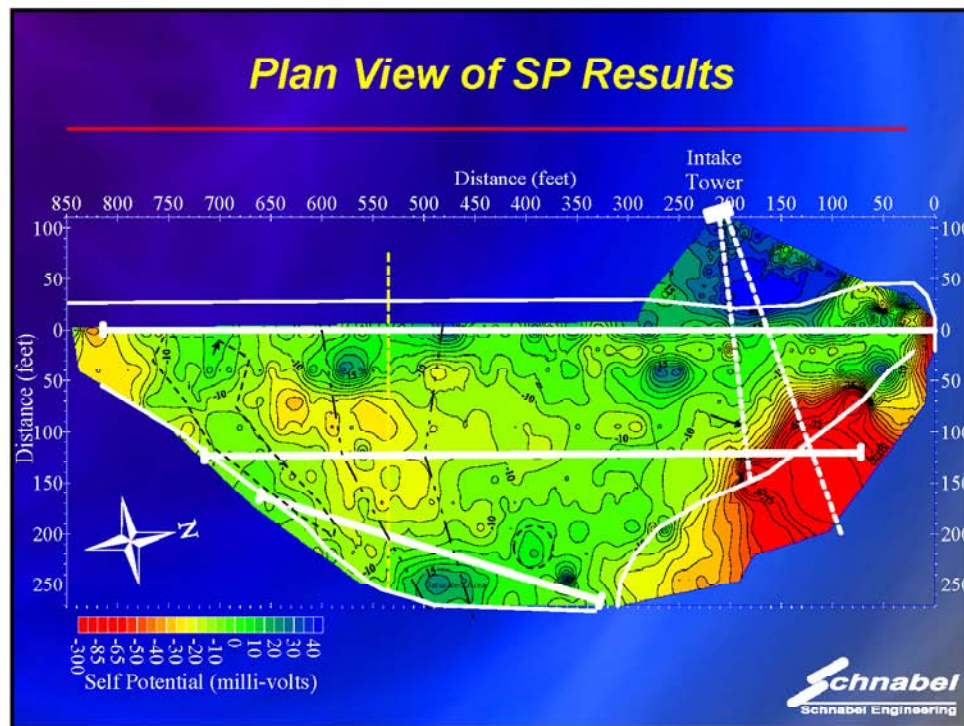


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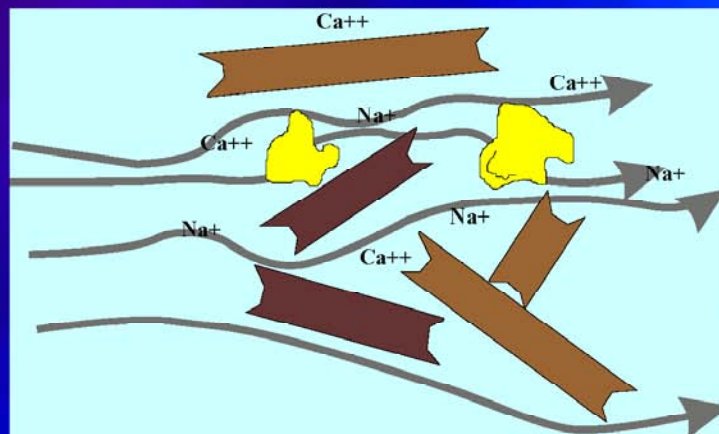
Plan View of the Dam



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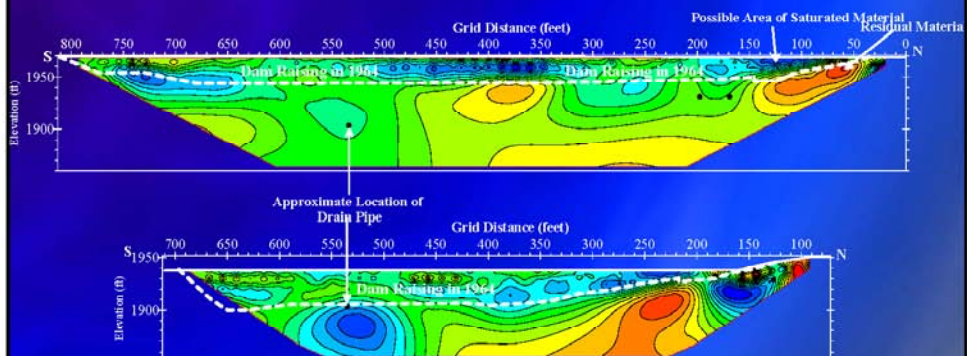


Electrical Flow Through Earth Materials



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Resistivity Results



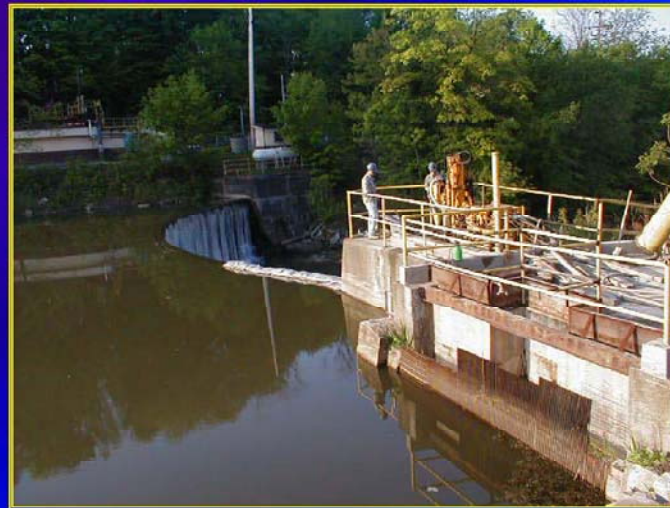
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Example 2: SP On Water, Chagrin Falls, OH



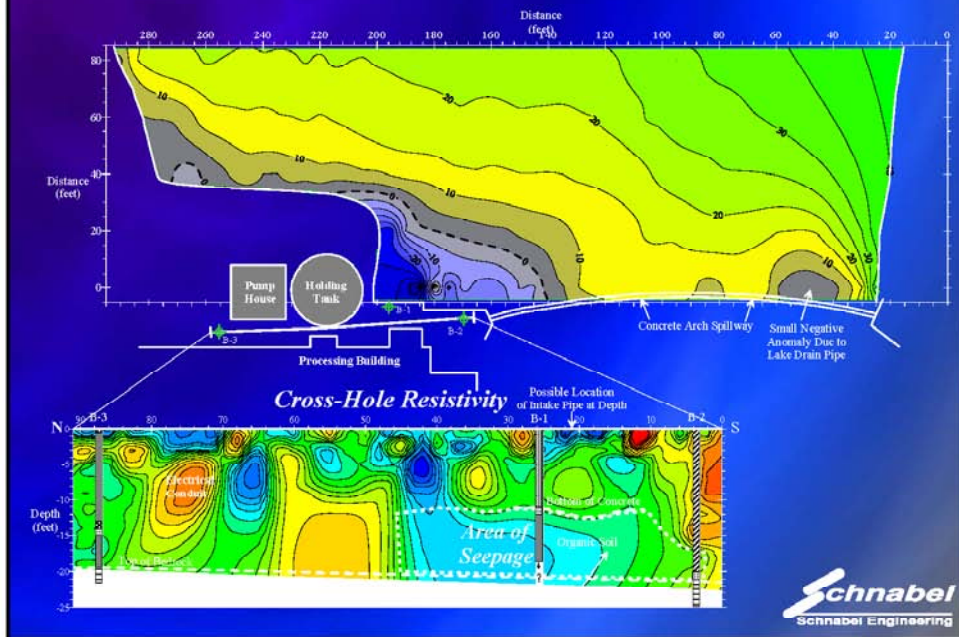
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Seepage Through or Around Spillway?



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Through Embankment Adjacent to Intake



Example 3, Lake Logan, NC

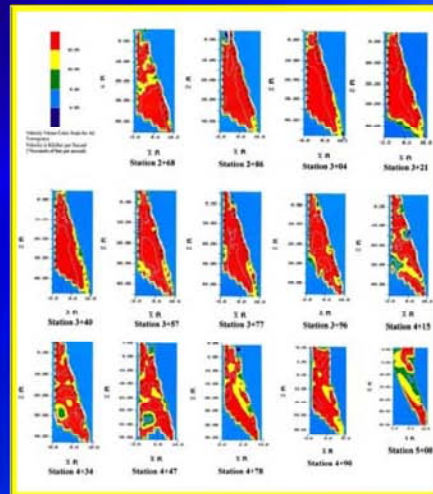
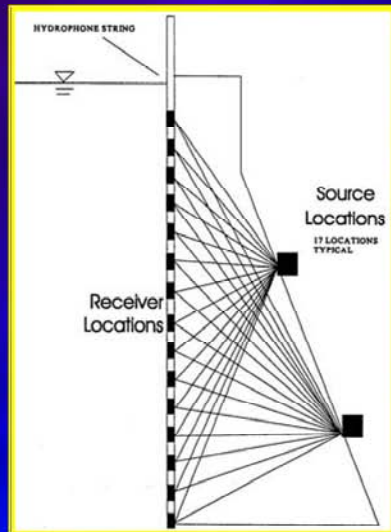


**Sonic Analysis of a
Concrete Arch Spillway**



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Tomographic Analysis of the Sonic Data to Locate Poor Concrete Sections



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Example 4, Concrete Spillway Slabs

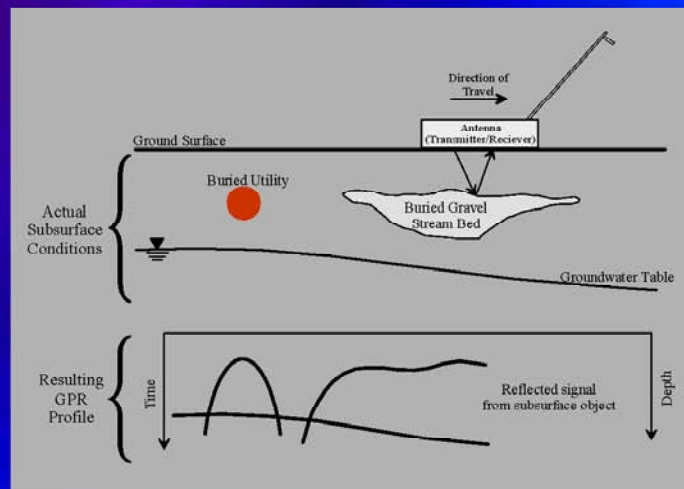


**Finding Voids
Under Spillways**



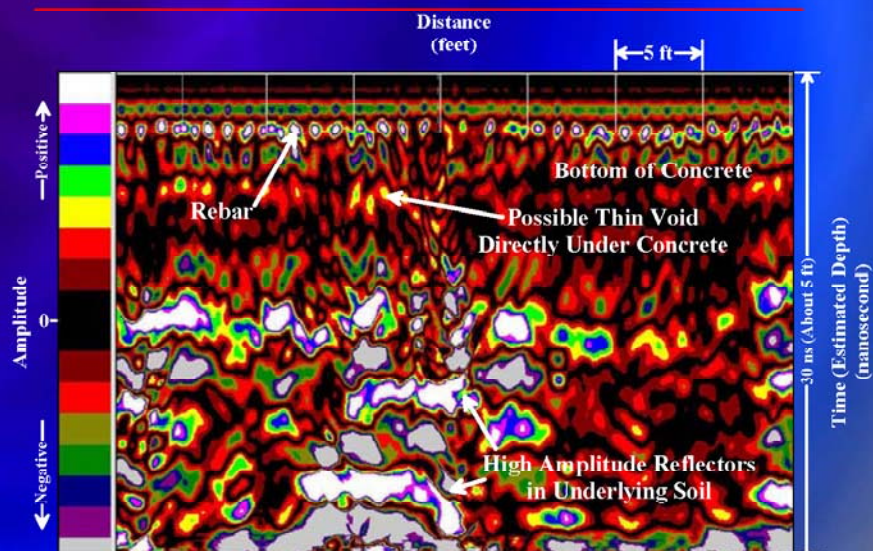
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Ground Penetrating Radar (GPR)



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GPR Results – “Typical” Voids



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